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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/676,645

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Gyung-Su Cho

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06/14/2006

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EXAMINER

NADAV, ORI

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 06/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/676,645	Applicant(s) CHO, GYUNG-SU	
	Examiner Ori Nadav	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5,8 and 21-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5,8 and 21-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>5/31/06</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Objections

Claim 21 is objected to because of the following informalities: The phrase "the pad" should read "a pad". Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 31 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claimed limitation of an alloy layer being exposed through the pad, as recited in claim 31, is unclear how the alloy layer can be exposed through the pad since the pad covers the alloy layer.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5, 23, 26-28 and 30 are rejected under 35 U.S.C. 102(e) as being anticipated by Sekiguchi (2002/0024142).

Regarding claim 1, Sekiguchi teaches in figure 1 and related text a semiconductor device comprising:

a via over a semiconductor substrate 100;

a barrier metal layer 102 on a surface of the via;

a metal line 103 comprises copper in the via over the barrier metal layer; and

an alloy layer 111, 115 on an upper surface of the metal line, wherein the alloy layer comprises a metal of the metal line and a low melting point metal having a melting point less than or equal to 1000 degrees C is selected from the group consisting of aluminum, lead, and silver (paragraph [0055]), wherein

the thickness of the alloy layer is less than a thickness of the metal line, wherein

a protection layer 104 made of silicon nitride or silicon oxynitride (paragraph [0051]) is formed on the metal line except where a pad is formed, wherein

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the barrier metal comprises a metal selected from the group consisting of Ti, Ta, TiN, and TaN, and

an insulation layer 101 comprises oxide (paragraph [0064]) over the semiconductor device, wherein the via is within the insulation layer, wherein

the barrier metal layer prevents the diffusion of copper from the metal line into the substrate, wherein

the barrier metal layer covers all surfaces of the via

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 24-25 and 32 rejected under 35 U.S.C. 103(a) as being unpatentable over Sekiguchi.

Regarding claims 24 and 32, Sekiguchi teaches in figure 1 and related text substantially the entire claimed structure, as applied to claim 1 above, except stating that the thickness of the barrier metal layer.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a barrier metal layer having a thickness of 500A in

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Sekiguchi's device in order to prevent the diffusion of the copper out of the via, as is well known in the art.

Regarding claim 25, the claimed limitation of forming an alloy layer comprises a reaction product of the metal line and the low melting point metal is a process limitation which would not carry patentable weight in this claim drawn to a structure, because distinct structure is not necessarily produced.

Note that a "product by process" claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and *In re Marosi et al.*, 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that the applicant has the burden of proof in such cases, as the above case law makes clear.

Claims 5, 8, 21-22, 31 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekiguchi in view of Liu et al. (6,638,867).

Regarding claims 5, 8, 21-22 and 31, Sekiguchi teaches in figure 1 and related text substantially the entire claimed structure, as applied to claim 1 above, except a pad.

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Liu et al. teach in figure 1 and related text a pad 24.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a pad in Sekiguchi's device in order to provide external connections to the device.

Regarding claims 8 and 22, the width of the pad in prior art's device is less than a width of the via.

Regarding claim 34, Liu et al. teach in figure 6D and related text a metal layer 32 contacting the substrate 30.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a metal layer contacting the substrate, such that the barrier metal layer contacts the substrate, in Sekiguchi's device, in order to use the device in application which requires electrical connection to the active regions in the substrate. provide external connections to the device.

Claims 1, 26, 29 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grass (5,563,099).

Grass teaches in figure 7 and related text a semiconductor device comprising:

- a via over a semiconductor substrate 10;

- a barrier metal layer 14a on a surface of the via;

- a metal line 14b in the via over the barrier metal layer; and

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an alloy layer 14c on an upper surface of the metal line, wherein the alloy layer comprises a metal of the metal line and a low melting point metal,

an insulation layer 13 over the semiconductor device, wherein the via is within the insulation layer, wherein

the alloy layer 14c is completely within the via, and wherein

a top surface of the alloy layer is lower than a top surface of the insulation layer.

Grass does not explicitly state forming a via and that the low melting point metal having a melting point less than or equal to 1000 degrees C.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a low melting point metal having a melting point less than or equal to 1000 degrees C in Grass's device in order to improve the device characteristics by using a low melting point material.

Regarding claim 25, the claimed limitation of forming a via, this is a process limitation which would not carry patentable weight in this claim drawn to a structure, because distinct structure is not necessarily produced.

Response to Arguments

Applicant's arguments with respect to claims 1-6, 8 and 21-34 have been considered but are moot in view of the new ground(s) of rejection.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to be 'Ori Nadav', written in a cursive style.

O.N.
6/10/06

ORI NADAV
PRIMARY EXAMINER
TECHNOLOGY CENTER 2800